receives reflected light from said cantilever and detects an angular deflection of a free end of said cantilever; and

said atomic force microscope further comprising an optical assembly including at least one steering lens to guide light emitted from said light source onto said cantilever to follow substantially a fixed position on said cantilever during movement of said scanning mechanism.--

--43. The atomic force microscope as recited in claim 42, wherein light reflected to said position detector does not pass through said steering lens.--

--44. An atomic force microscope as recited in claim 43, wherein said position detector is located substantially at a point where light beams reflected from said cantilever converge when said cantilever is undeflected during a full extent of movement of said scanning mechanism so that said position detector is substantially sensitive to a deflection motion of said cantilever rather than a scanning motion of said cantilever.--

--45. An atomic force microscope as recited in claim 42, wherein a stylus is included substantially on the free end of said cantilever.--

--46. An atomic force microscope as recited in claim 42, wherein said scanning mechanism comprises a piezoelectric tube.--

--47. An atomic force microscope as recited in claim 46, wherein said steering lens is included in said piezoelectric tube.--

--48. A method of operating an atomic force microscope having an optical lever system with a light source, a cantilever and a position detector, and further having a steering lens assembly attached to a steering mechanism, the method comprising the steps of:

generating light;

directing said light onto said cantilever using said steering lens assembly so that said light strikes a substantially fixed position on said cantilever during a movement of said scanning mechanism; and

receiving a reflected light reflected from said cantilever using said position detector to detect an angular bending of said cantilever.--

--49. A method as recited in claim 48, further comprising the steps of:

splitting said light into a first beam which strikes said cantilever and a second beam which is directed to a second position detector.--

--50. A scanning force microscope device comprising in combination:

a. a sensing probe having a substantially reflective surface on one side and a scanning tip on the opposite side, said tip adapted to be positioned adjacent a surface to be scanned;

b. illuminating means for generating a radiant energy beam and for applying said beam to said reflective surface;

c. position control means coupled to said sensing probe for moving

said scanning tip substantially parallel to a surface to be scanned in a predetermined pattern and for moving said scanning tip orthogonal to the surface to follow the counters of the surface;

d. beam positioning means for directing said radiant energy beam to follow said sensing probe through lateral motion of said probe; and

e. detector means adapted to receive the energy beam reflected from said reflective surface and operable in response to movement of said reflected energy beam corresponding to position changes to said sensing probe relative to the surface to be scanned to produce a motion representing signal corresponding to tip movement following the contours of the scanned surface, whereby tip motion in a direction orthogonal to scanning motion results in a series of electrical signals corresponding to and representative of the surface contours of the scanned surface.--

--51. In a scanning force microscope having a sensing lever having a tip mounted for movement in response to relative vertical distance changes between the tip and a sample surface as the tip moves laterally with respect to the sample

surface, apparatus for sensing the vertical movement of the tip relative to the surface being scanned and for creating a signal representative of such vertical movement comprising:

a. a reflective surface carried by the sensing lever;

b. an energy source positionally decoupled from lateral movement of the sensing lever for emitting a radiant energy beam including focussing means for applying said beam to said reflective surface;

c. control means for moving the sensing lever and tip laterally over the surface of a sample to be scanned including beam directing means for causing said radiant energy beam to follow the lateral motion of the sensing lever;

d. driving means for moving the sensing lever and tip in a vertical direction towards and away from the surface of the sample to be examined; and

e. detection means positioned to receive said energy beam after reflection from said reflective surface for signalling changes in the beam position, said changes corresponding to and being representative of vertical displacement of the sensing elver tip during lateral motion over the sample surface.--

--52 The scanning force microscope of claim 51, further including means for creating an image of the lever in space at a point in space such that said image does not appear to move when the lever is moved laterally.--

--53. The scanning force microscope of claim 51 further including a lens system attached to a deformable ceramic transducer having an axis to create an image of the lever substantially at a selected point along the axis of said transducer at which the lever image appears to be stationary, notwithstanding lateral movement of the lever.--

B2 cont'd

--54. The scanning force microscope of claim 51 wherein said detection means are isolated from and independent of lever tip movement, said detection means being responsive to the light beam reflected from said reflective surface for signalling changes in light beam position resulting from bending movement of the sensing lever, whereby detection means output signals correspond to and are representative of the vertical motion of the sensing lever tip and represent the contours of a scanned surface.--

--55. The scanning force microscope of claim 51 wherein detection means output signals are processed to produce control signals which correspond to and are representative of the contours of a scanned surface.--

--56. In a scanning force microscope having a lever with a reflecting surface and a sensing tip wherein the sensing tip is responsive to forces resulting from the

proximity of the sensing tip to a sample surface under investigation, apparatus for sensing the response of the tip to the forces comprising:

a. a light beam source for generating a light beam, said source being mounted to permit relative lateral motion between said source and the lever during scanning;

b. a light beam steering device for laterally steering said light beam to follow the reflective surface of said lever as said elver moves relative to said light beam source;

c. a motion control device for creating relative motion between said sensing tip and said sample surface; and

d. a detection device for detecting light reflected from said lever.--

B2 contd

--57. The microscope of claim 56 wherein the light beam source is a laser.--

--58. The microscope of claim 56 further including at least one lens interposed between the light beam source and said reflective surface wherein said beam steering device comprises a free end and a fixed end, said free end being coupled to said lens.--

--59. The microscope of claim 56 further including at least one mirror interposed between the light beam source and said reflective surface wherein the beam steering device comprises a free end and a fixed end, said free end being coupled to said mirror.--

--60. The microscope of claim 56 wherein said motion control device includes a piezo-electric device having a free end and a fixed end, said free end of said motion control device being adapted to provide relative scanning motion between said tip and the sample surface under investigation.--

--61. The microscope of claim 56 wherein said detection device is an array of at least two photodiodes.--

B7 cont'd

--62. The microscope of claim 56 wherein the sensing tip is in contact with the sample surface under investigation.--

--63. The microscope of claim 56 wherein said detection device is adapted to create an error signal which can be used in conjunction with applied position signals to create a three dimensional map of said sample surface.--

--64. The microscope of claim 56 wherein said detection device generates an error signal which is processed to create a control signal to be used in conjunction with applied position signals to create a three dimensional map of the sample surface.--

--65. The microscope of claim 56 wherein said light beam steering device is integral with said motion control device.--

--66. In a scanning force microscope having a lever with a reflecting surface and a sensing tip wherein the sensing tip is responsive to forces resulting from the proximity of the sensing to a sample surface under investigation, apparatus for

sensing the response of the tip to the forces comprising:

a. a light beam source for generating a light beam;

b. a motion control device for creating relative motion between the sensing tip and the sample surface, said motion control device having a fixed end and a free end, said free end being adapted to provide relative scanning motion between the scanning tip and the sample surface;

c. at least one lens interposed in said beam of light between said source and the reflecting surface, said lens fixed to the frame of reference of said free end of said motion control device such that said lens causes said beam to track laterally the motion of said reflecting surface; and

d. a detection device for detecting light reflected from the reflecting surface.--

--67. The microscope of claim 66 wherein said light beam source is a laser.--

--68. The microscope of claim 66 wherein said detection device is an array of at least two photodiodes.--

--69. The microscope of claim 66 wherein the sensing tip is in contact with the sample surface under investigation.--

--70. The microscope of claim 66 wherein said detection device is adapted to create an error signal which can be used with applied position signals to create a three dimensional map of the sample surface.--

--71. The microscope of claim 66 wherein said detector generates a signal which is processed to create a control signal to servo said motion control device, wherein said control signal is further used in conjunction with applied position signals to create a three dimensional map of the sample surface.--

--72. The microscope of claim 66 further including at least one mirror interposed between the light beam source and said reflective surface wherein the beam steering device comprises a free end and a fixed end, said free end being coupled to said mirror.--

--73. The microscope of claim 66 wherein at least said one lens is fixed to the frame of reference of the free end of said motion control device.--

--74. The method of operating a scanning force microscope having a probe with a lever having a reflecting surface and a sensing tip responsive to forces resulting from the proximity of the tip to a sample surface under investigation wherein said probe is scanned across a surface, and wherein the scanning force microscope further has a light beam source for generating a light beam wherein the light beam source does not move with the scanning probe during scanning, the

method comprising the steps of:

a. steering the light beam to follow the motion of the sensing probe;

b. reflecting the light beam from the reflecting surface; and

c. detecting the light beam reflected from the moving probe with a detector.--

B7 cancel

--75. The microscope of claim 74 including the further step of bringing the sensing tip into contact with the surface of the sample.--

--76. The microscope of claim 74 including the further step of processing the signal generated from the detection of the reflected beam, to generate a control signal which is transmitted to a translation device which causes said sensing tip to move.

--77. The microscope of claim 74 including the further step of generating an image from the control signal.

IN THE ABSTRACT

Page 44, line 5, delete "a"; same line, delete "beam";

Page 44, line 6, change "laser" to --light--; same line, change "said" to --a--;

Page 44, line 7, change "laser" to --light--;

Page 44, line 9, change "laser" to --light--;